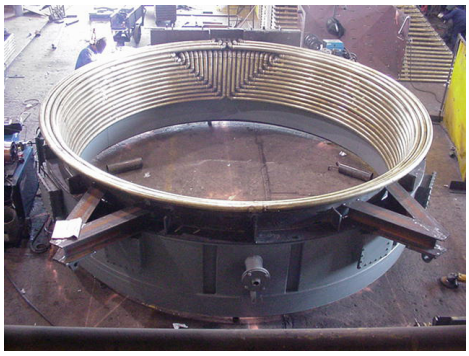
Improving the System Life of Basic Oxygen and Electric Arc Furnace Hoods, Roofs, and Side Vents

Improved systems promise to increase steelmaking furnace safety and productivity

Hoods, roofs, and sidewall systems enable the effluent gasses (≥3000ºF) from basic oxygen and electric arc furnaces to be properly cooled and processed prior to being discharged or vented. Large amounts of heat, dust, and waste gas are generated by the steelmaking reactions in these furnaces. These reactions create an aggressive environment that shortens the life span of the hoods, roofs, and sidewall systems. This project focuses on developing materials and systems that will extend the life of the basic oxygen furnace (BOF) and electric arc furnace (EAF) hood and roof systems. Reducing material failures in these systems will increase furnace productivity and improve safety. The project goal is to double the current hood, roof, and sidewall system life while reducing the overall system cost by 20%. This will reduce furnace downtime related to hood, roof, and sidewall-related problems by over 25%.



Aluminum Bronze Skirt

As a part of this project, an aluminum bronze BOF hood skirt has been developed and demonstrated at Republic Engineered Products, Inc.'s Lorain Hot Rolled Bar Plant. Republic's hood system collects and cools effluent gases formed during BOF steelmaking, such as carbon monoxide and carbon dioxide. The hood consists of a tube system that quickly pumps cool water through each tube to reduce the gases' temperature. Once the gases are collected, they are combusted prior to discharge to convert carbon monoxide to carbon dioxide. The hood also removes larger particles that are swept up to the hood with the gas stream. The particles settle in a classifier and are dewatered for disposal in bins or hoppers. The hood is connected to the vessel at the metal skirt, which fits on top of the furnace. The skirt, conventionally made of plain carbon steel tubing, is especially vulnerable to damage because it is closest to the furnace, where slag splashing occurs and waste gases are at their hottest. These skirts require frequent repairs due to material failures that result from thermally-induced stress cracking and corrosion on both the process and non-process side of the skirt tube bundle. Cracked pipes are a serious issue because an explosion can occur if water contacts the molten steel in the furnace.

Benefits for Our Industries and Our Nation

- Improves BOF productivity and lifetime
- Requires fewer repairs
- Increases operational safety

Project Participants:

Republic Technologies, Inc.

ISG Steel, Inc.

Weirton Steel Corp.

The Timken Company

North Star BHP Steel Ltd.

WCI Steel

Babcock & Wilcox

RDI Riggs Distler-IMSI

F.W. Gartner Thermal Spraying Co.

AmeriFab, Inc.

GE Infrastructure, Water & Process Technologies (formerly BetzDearborn)

Wheeling Pittsburgh Steel

AK Steel

Oak Ridge National Laboratory

Contact:

Robert M. Purgert (Principal Investigator)

(216) 643-2952

Purgert@energyinohio.com

PROJECT PLANS AND PROGRESS:

Demonstration Results:

- The aluminum bronze skirt was installed in 2004 on Republic's Lorain backup BOF vessel. Since then, the backup vessel has run over 290 heats without requiring a single repair. This is more than a three-fold improvement over the carbon steel skirts which typically last for about 80 heats before needing repairs. Approximately 60% of the heats were for specialty alloys and re-sulfurized steel grades and the balance was for standard carbon grades.
- Off-gas analyses were conducted on each heat and the data combined with periodic infrared imaging to monitor the level of material deterioration.
- In August 2005, Republic's Lorain backup vessel with the aluminum bronze skirt was converted into the primary production vessel. As of early September 2005, this vessel has run over 300 additional heats without requiring any maintenance on the skirt.

Future Plans:

- Oak Ridge National Laboratory is currently testing ceramic coating samples that can withstand temperatures of up to 2,300°F. This material is expected to provide resistance to corrosion and slag sticking as well as abrasion resistance.

Steel Program

The Steel Industry of the Future (IOF) subprogram is based in the Industrial Technologies Program (ITP) within the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy. The subprogram works with the steel industry to promote development of more energy-efficient and environmentally sound technology for steel processing. Guided by industry-identified research and development priorities, ITP's steel portfolio addresses those priorities that offer the greatest potential for energy savings in cokeless ironmaking, next-generaton steelmaking, and yield improvement. To learn more about Steel IOF activities, visit the program web site at: www.eere.energy.gov/industry/steel/

A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

For more information contact:
EERE Information Center
1-877-EERE-INF (1-877-337-3463)
www.eere.energy.gov

U.S. Department of Energy
Energy Efficiency and Renewable Energy
Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

CPS #17521.
September 2005